

#### IV. CHEMICAL RELEASE AND TRANSFER PROFILE

This section is designed to provide background information on the pollutant releases that are reported by this industry. The best source of comparative pollutant release information is the Toxic Release Inventory System (TRI). Pursuant to the Emergency Planning and Community Right-to-Know Act (EPCRA), TRI includes self-reported facility release and transfer data for over 600 toxic chemicals. Facilities within SIC Codes 20-39 (manufacturing industries) that have more than 10 employees, and that are above weight-based reporting thresholds are required to report TRI on-site releases and off-site transfers. The information presented within the sector notebooks is derived from the most recently available (1993) TRI reporting year (which then included 316 chemicals), and focuses primarily on the on-site releases reported by each sector. Because TRI requires consistent reporting regardless of sector, it is a useful tool for drawing general comparisons across industries.

Although this sector notebook does not present historical information regarding TRI chemical releases, please note that in general, toxic chemical releases have been declining over time. In fact, according to the 1993 Toxic Release Inventory Data Book, reported releases dropped by 43 percent between 1988 and 1993. Although on-site releases have decreased, the total amount of reported toxic waste has not declined because the amount of toxic chemicals transferred off-site has increased. Transfers have increased from 3.7 billion pounds in 1991 to 4.7 billion pounds in 1993. Better management practices have led to increases in off-site transfers of toxic chemicals for recycling. More detailed information can be obtained from EPA's annual Toxics Release Inventory Public Data Release book (which is available through the EPCRA Hotline at 800-535-0202), or directly from the Toxic Release Inventory System database (for user support call 202-260-1531).

Wherever possible, the sector notebooks present TRI data as the primary indicator of chemical release within each industrial category. TRI data provide the type, amount and media receptor of each chemical released or transferred. When other sources of pollutant release data have been obtained, these data have been included to augment the TRI information.

##### **TRI Data Limitations**

The reader should keep in mind the following limitations regarding TRI data. Within some sectors, the majority of facilities are not subject to TRI reporting because they are not considered manufacturing industries, or

because they are below TRI reporting thresholds. Examples are the mining, dry cleaning, printing, and transportation equipment cleaning sectors. For these sectors, release information from other sources has been included.

The reader should also be aware that TRI "pounds released" data presented within the notebooks is not equivalent to a "risk" ranking for each industry. Weighting each pound of release equally does not factor in the relative toxicity of each chemical that is released. The Agency is in the process of developing an approach to assign toxicological weightings to each chemical released so that one can differentiate between pollutants with significant differences in toxicity. As a preliminary indicator of the environmental impact of the industry's most commonly released chemicals, the notebook briefly summarizes the toxicological properties of the top five chemicals (by weight) reported by each industry.

### **General Definitions**

**SIC Code** -- is the Standard Industrial Classification (SIC) is a statistical classification standard used for all establishment-based Federal economic statistics. The SIC codes facilitate comparisons between facility and industry data.

**TRI Facilities** -- are manufacturing facilities that have 10 or more full-time employees and are above established pollutant release and transfer thresholds. Manufacturing facilities are defined as facilities in Standard Industrial Classification primary codes 20-39. Facilities must submit estimates for all chemicals that are on the EPA's defined list and are above throughput thresholds.

### **Data Table Column Heading Definitions**

The following definitions are based upon standard definitions developed by EPA's Toxic Release Inventory Program. The categories below represent the possible pollutant destinations that can be reported.

**RELEASES** -- are an on-site discharge of a toxic chemical to the environment. This includes emissions to the air, discharges to bodies of water, releases at the facility to land, as well as contained disposal into underground injection wells.

**Releases to Air (Point and Fugitive Air Emissions)** -- Include all air emissions from industry activity. Point emission occur through confined

air streams as found in stacks, ducts, or pipes. Fugitive emissions include losses from equipment leaks, or evaporative losses from impoundments, spills, or leaks.

**Releases to Water (Surface Water Discharges)** -- encompass any releases going directly to streams, rivers, lakes, oceans, or other bodies of water. Any estimates for stormwater runoff and non-point losses must also be included.

**Releases to Land** -- includes disposal of toxic chemicals in waste to on-site landfills, land treated or incorporation into soil, surface impoundments, spills, leaks, or waste piles. These activities must occur within the facility's boundaries for inclusion in this category.

**Underground Injection** -- is a contained release of a fluid into a subsurface well for the purpose of waste disposal.

**TRANSFERS** -- is a transfer of toxic chemicals in wastes to a facility that is geographically or physically separate from the facility reporting under TRI. The quantities reported represent a movement of the chemical away from the reporting facility. Except for off-site transfers for disposal, these quantities do not necessarily represent entry of the chemical into the environment.

**Transfers to POTWs** -- are wastewaters transferred through pipes or sewers to a publicly owned treatment works (POTW). Treatment and chemical removal depend on the chemical's nature and treatment methods used. Chemicals not treated or destroyed by the POTW are generally released to surface waters or landfilled within the sludge.

**Transfers to Recycling** -- are sent off-site for the purposes of regenerating or recovering still valuable materials. Once these chemicals have been recycled, they may be returned to the originating facility or sold commercially.

**Transfers to Energy Recovery** -- are wastes combusted off-site in industrial furnaces for energy recovery. Treatment of a chemical by incineration is not considered to be energy recovery.

**Transfers to Treatment** -- are wastes moved off-site for either neutralization, incineration, biological destruction, or physical separation. In some cases, the chemicals are not destroyed but prepared for further waste management.

**Transfers to Disposal** -- are wastes taken to another facility for disposal generally as a release to land or as an injection underground.

#### IV.A. EPA Toxics Releases Inventory For the Pulp and Paper Industry

According to Toxic Release Inventory (TRI) data from SIC codes 261-265, the pulp and paper industry released (to the air, water, or land) and transferred (shipped off-site) a total of approximately 218 million pounds of toxic chemicals during calendar year 1993<sup>b</sup>. This represents less than 4 percent of the total pounds of TRI chemicals released and transferred by all manufacturers that year. In comparison, the chemical industry (SIC 28) produced 2.5 billion pounds that year, accounting for 33 percent of all releases and transfers during that period.

The pulp and paper industry's releases have been declining in recent years. The 1993 release total represented a 8 percent reduction over the previous year, and a 22 percent reduction since 1988. This reduction was not as great as manufacturers' average of 43 percent for that period. The pulp and paper industry had the sixteenth lowest decrease in TRI releases and transfers of all TRI reporting industries. The greatest reductions were achieved in the electrical and electronic equipment sector (SIC 36) with a 69 percent reduction.

Given that pulp and paper industry production increased approximately 20 percent during the 88-92 period, one possible reason for these reductions in TRI data was the industry's efforts at pollution prevention. At the facility level, the pulp and paper industry reported the ninth highest level of pollution prevention activities among the 19 TRI reporting industries. Within the two digit SIC code 26, which includes paper conversion in addition to pulp and paper mills, 40 percent indicated source reduction activities at their facilities, somewhat higher than the average for all TRI facilities. The activities cited most often by the pulp and paper industry were good operating practices, process modifications, and raw material modifications. The highest pollution prevention activity was done by the laboratory, medical, and photographic instrument manufacturing industry (SIC 38) at 54 percent industry participation.

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<sup>b</sup> Unless otherwise indicated, TRI data for SIC codes 261-265 were used for pulp and paper release and transfer values in this section and the tables therein.

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Comparisons of the pounds released or transferred per facility demonstrate that the pulp and paper industry had the highest per facility TRI chemical releases of all industries in 1993. The mean amount of toxic chemical **releases** per facility was approximately 120,000 pounds for all TRI facilities. The toxic chemical releases of the average pulp and paper facility were fivefold that amount, approximately 550,000 pounds. The second highest per facility releases were from the chemical industry (SIC 28) at approximately 316,000 pounds per facility. The mean amount **transferred** by facilities was greater than that of pulp and paper mills (202,000 pounds transferred off-site per facility compared to 156,700 per mill). The industry with the largest transfers per facility was the petroleum industry (SIC 29), which transferred approximately 1,894,000 pounds per facility. This value was by far the largest of TRI industries (three times that of the closest industry) and skewed the TRI mean transfer value.

### Media comparison of TRI releases

The total amount of TRI toxic chemicals generated by the pulp and paper industry is a gross profile of the types and relative amounts of chemical outputs from mill processes. Additional information which can be related back to possible compliance requirements is available from the distribution of chemical releases across specific media within the environment. The TRI data requires filers to separate the total releases for the pulp and paper industry for air, water, and land releases. This distribution across media can also be compared to the profile of other industry sectors.

The pulp and paper industry releases 87 percent of its total TRI poundage to the air, approximately 10 percent to water and POTWs, and 2 percent is transferred off site or disposed on land. This release profile differs from other TRI industries which average approximately 93 percent to air 6 percent to land, and 1 percent to water. A larger proportion of water releases correlates with the water intensive processes of the pulp and paper industry. An average mill requires 10 million gallons of influent water per day and will produce the corresponding amount of effluent waters. Examining the pulp and paper industry's TRI reported toxic chemicals by chemical, highlights the likely origins of industry releases (see Exhibit 23).

Air releases can be traced to a variety of sources. Approximately 50 percent are methanol, a by-product of the pulp making process. The other major air toxic chemicals: chlorinated compounds, sulfuric acid, and the chelator methyl ethyl ketone, originate in the bleaching stage. Methanol also accounts for approximately 40 percent of the water releases by pulp

and paper facilities. Overall, methanol represents over 49 percent of the pulp and paper industry's TRI releases and transfers.

The diversity of processes in the pulp and paper industry can be seen in the diversity of chemicals found in the TRI report. The TRI chemical used by the greatest number of mills is sulfuric acid. In addition, some TRI chemicals are each only used by a few mills, suggesting process specific needs such as paper finishing or use in wet additives.

**Exhibit 23: Releases for Pulp and Paper Facilities in TRI for 1993, by Number of Facilities Reporting (Releases reported in pounds/year)**

CHEMICAL NAME	# REPORTING CHEMICAL	FUGITIVE AIR	POINT AIR	WATER DISCHARGES	UNDERGROUND INJECTION	LAND DISPOSAL	TOTAL RELEASES	AVG. PER FACILITY
SULFURIC ACID	239	33,964	12,820,988	141,347	0	22,165	13,018,464	54,471
CHLORINE	182	93,244	1,267,957	35,863	0	3,000	1,400,064	7,693
HYDROCHLORIC ACID	162	592,882	27,782,172	640,935	0	0	29,015,989	179,111
AMMONIA	160	205,774	4,678,739	6,603,167	0	53,363	11,541,043	72,132
METHANOL	144	5,988,377	68,737,288	7,103,389	0	534,976	82,364,030	571,972
PHOSPHORIC ACID	141	1,769	10	34,957	0	30,370	67,106	476
ACETONE	120	342,478	6,210,032	406,826	2	34,131	6,993,469	58,279
CATECHOL	101	40	350	45,188	0	3,605	49,183	487
CHLOROFORM	88	3,578,682	7,816,331	261,466	0	9,399	11,665,878	132,567
CHLORINE DIOXIDE	87	12,264	1,357,528	250	0	0	1,370,042	15,748
METHYLETHYL KETONE	68	24,476	1,303,147	49,569	0	14,373	1,391,565	20,464
PHENOL	51	11,666	224,547	36,216	0	3,849	276,278	5,417
FORMALDEHYDE	33	16,350	839,567	16,963	0	5,581	878,461	26,620
ZINCCOMPOUNDS	28	254	315,280	233,759	0	2,710,743	3,260,036	116,430
NITRICACID	22	280	18	2,500	0	0	2,798	127
AMMONIUM	21	0	0	71,898	0	6,324	78,222	3,725
ETHYLENE GLYCOL	21	3,254	2,199	36,403	0	263	42,119	2,006
GLYCOL ETHERS	19	68,990	71,044	191,342	0	1,160	332,536	17,502
XYLENE(MIXED ISOMERS)	15	9,635	391,332	1,358	0	37	402,362	26,824
ACETALDEHYDE	14	1,606	843,584	1,355	0	680	847,225	60,516
COPPER COMPOUNDS	8	0	255	1,206	0	2,816	4,277	535
AMMONIUM	7	174	0	1,503,700	0	1,700	1,505,574	215,082
1,2,4-TRIMETHYLBENZENE	7	39,570	36,200	9,685	0	750	86,205	12,315
BARIUM COMPOUNDS	6	32	945	13,790	0	149,626	164,393	27,399
TOLUENE	6	110,852	1,439,370	73	0	0	1,550,295	258,383
CHROMIUM COMPOUNDS	5	250	3,396	67,500	0	43,214	114,360	22,872
DIETHANOLAMINE	5	300	250	750	0	0	1,300	260
MANGANESE COMPOUNDS	5	0	255	36,136	0	37,600	73,991	14,798
N-BUTYLALCOHOL	4	6,790	58,000	3,069	0	0	67,859	16,965
BENZENE	3	162	299,249	26	0	11	299,448	99,816
NAPHTHALENE	3	500	19,530	2,870	0	5,135	28,035	9,345
DICHLOROMETHANE	2	241,000	18,800	311	0	1	260,112	130,056
MANGANESE	2	5	27,700	111,029	0	51,572	190,306	95,153
METHYLISOBUTYL KETONE	2	0	69,661	85	0	1	69,747	34,874
STYRENE	2	15,121	34	0	0	0	15,155	7,578
ACRYLIC ACID	1	0	0	92	0	0	92	92
ANTIMONY COMPOUNDS	1	0	0	0	0	160	160	160
ASBESTOS(FRIABLE)	1	750	0	0	0	0	750	750
BIPHENYL	1	3	0	430	0	0	433	433
BUTYLBENZYL PHTHALATE	1	5,800	47,000	0	0	0	52,800	52,800
DECABROMODIPHENYL	1	0	0	0	0	380	380	380
DIBUTYL PHTHALATE	1	0	0	0	0	0	0	0
FREON 113	1	0	0	0	0	0	0	0
HYDROGEN FLUORIDE	1	0	31,532	0	0	0	31,532	31,532
NITRILOTRIACETIC ACID	1	0	0	0	0	0	0	0
O-CRESOL	1	0	150,000	0	0	0	150,000	150,000
PROPYLENE	1	0	0	0	0	0	0	0
TOTAL	309	11,407,294	136,864,290	17,665,503	2	3,726,985	169,664,074	549,070

**Exhibit 24: Transfers for Pulp and Paper Facilities in TRI in 1993, by Number of Facilities Reporting (Transfers reported in pounds/year)**

CHEMICAL NAME	# REPORTING CHEMICAL	POTW DISCHARGES	DISPOSAL	RECYCLING	TREATMENT	ENERGY RECOVERY	TOTAL TRANSFER \$	AVG. PER FACILITY
SULFURIC ACID	239	102,531	5,964	750	18,390	0	127,635	534
CHLORINE	182	13,943	255	0	2,750	0	16,948	93
HYDROCHLORIC ACID	162	120,311	500	750	0	0	121,561	750
AMMONIA	160	579,150	119,472	250	35,753	0	734,625	4,591
METHANOL	144	34,845,356	997,221	5,632	7,071,107	397,364	43,316,680	300,810
PHOSPHORIC ACID	141	5	0	0	600	0	605	4
ACETONE	120	671,274	22,661	184	71,885	5,296	771,300	6,428
CATECHOL	101	63,552	632	0	3,605	3,361	71,150	704
CHLOROFORM	88	424,947	3,376	266	51,003	0	479,592	5,450
CHLORINE DIOXIDE	87	0	0	0	0	0	0	0
METHYLETHYL KETONE	68	244,721	12,156	26,826	12,780	20,501	316,984	4,662
PHENOL	51	229,830	12,756	0	9,169	2,560	254,315	4,987
FORMALDEHYDE	33	31,889	7,254	250	7,740	30	47,163	1,429
ZINC COMPOUNDS	28	1,970	566,918	57,343	5,500	0	631,731	22,562
NITRIC ACID	22	0	0	0	0	0	0	0
AMMONIUM	21	14,767	500	0	0	0	15,267	727
ETHYLENE GLYCOL	21	135,500	113	2,950	10,018	0	148,581	7,075
GLYCOL ETHERS	19	289,631	2,607	0	16,893	0	309,131	16,270
XYLENE(MIXED ISOMERS)	15	0	0	997	250	500	1,747	116
ACETALDEHYDE	14	0	0	0	0	0	0	0
COPPER COMPOUNDS	8	5,439	37,256	3,954	10	0	46,659	5,832
AMMONIUM	7	3,892	29	0	0	0	3,921	560
1,2,4-TRIMETHYLBENZENE	7	250	262	0	2,500	0	3,012	430
BARIUM COMPOUNDS	6	19,000	41,631	55,081	150	0	115,862	19,310
TOLUENE	6	0	0	11,585	3,400	124,312	139,297	23,216
CHROMIUM COMPOUNDS	5	2,167	10,073	0	0	0	12,240	2,448
DIETHANOLAMINE	5	39,013	33	0	0	0	39,046	7,809
MANGANESE COMPOUNDS	5	0	40,900	0	0	0	40,900	8,180
N-BUTYLALCOHOL	4	0	0	0	38,000	1,500	39,500	9,875
BENZENE	3	0	0	0	0	0	0	0
NAPHTHALENE	3	0	0	0	0	0	0	0
DICHLOROMETHANE	2	0	0	0	0	0	0	0
MANGANESE	2	0	28,911	62,318	0	0	91,229	45,615
METHYLISOBUTYL KETONE	2	0	0	0	0	0	0	0
STYRENE	2	0	0	0	0	0	0	0
ACRYLIC ACID	1	0	0	0	0	0	0	0
ANTIMONY COMPOUNDS	1	0	3,300	0	0	0	3,300	3,300
ASBESTOS(FRIABLE)	1	750	498,000	0	0	0	498,750	498,750
BIPHENYL	1	0	0	0	0	0	0	0
BUTYLBENZYL PHTHALATE	1	7,200	0	0	0	0	7,200	7,200
DECABROMODIPHENYL OXIDE	1	0	8,000	0	0	0	8,000	8,000
DIBUTYL PHTHALATE	1	0	0	0	0	2,510	2,510	2,510
FREON 113	1	0	0	0	0	0	0	0
HYDROGEN FLUORIDE	1	0	0	0	0	0	0	0
NITROTRIACETIC ACID	1	0	0	0	0	0	0	0
O-CRESOL	1	0	0	0	0	0	0	0
PROPYLENE	1	0	0	0	0	0	0	0
TOTAL	309	37,847,088	2,420,780	229,136	7,361,503	557,934	48,416,441	156,688



The TRI database contains a detailed compilation of self-reported, facility-specific chemical releases. The top reporting facilities for this sector are listed below (Exhibit 25). Facilities that have reported only the SIC codes covered under this notebook appear on the first list. The second list (Exhibit 26) contains additional facilities that have reported the SIC code covered within this report, and one or more SIC codes that are not within the scope of this notebook. Therefore, the second list includes facilities that conduct multiple operations -- some that are under the scope of this notebook, and some that are not. Currently, the facility-level data do not allow pollutant releases to be broken apart by industrial process.

<b>Exhibit 25: Top 10 TRI Releasing Pulp and Paper Facilities, 1993 <sup>c</sup></b>		
<b>Ran k</b>	<b>Facility</b>	<b>Total TRI Releases in Pounds</b>
1	Westvaco Corp. Kraft Div. - North Charleston, SC	5,297,899
2	Westvaco Corp. Bleached Board Div. - Covington, VA	4,752,355
3	ITT Rayonier Inc. Port Angeles Pulp Div. - Port Angeles, WA	3,661,010
4	Inland Container Corp. Rome Linerboard Div. - Rome, GA	3,245,815
5	Stone Container Corp. Containerboard & Paper Div. - Florence, SC	3,049,918
6	Scott Paper Co. - Mobile, AL	3,009,185
7	CPI Kraft Div. - Wisconsin Rapids, WI	2,881,855
8	Champion International Corp. Courtland Mill - Courtland, AL	2,874,701
9	Great Southern Paper - Cedar Springs, GA	2,522,520
10	Alabama River Pulp Co. Inc. - Claiborne, AL	2,433,605
Source: U.S. EPA, Toxic Release Inventory Database, 1993.		

<sup>c</sup> Being included in this list does not mean that the release is associated with non-compliance with environmental laws.

**Exhibit 26: Top 10 TRI Releasing Facilities Reporting Pulp and Paper Industry SIC Codes to TRI, 1993<sup>d</sup>**

<b>Rank</b>	<b>SIC Codes Reported in TRI</b>	<b>Facility</b>	<b>Total TRI Releases in Pounds</b>
1	2611, 2631	Westvaco Corp. Kraft Div. - North Charleston, SC	5,297,899
2	2631	Westvaco Corp. Bleached Board Div. - Covington, VA	4,752,355
3	2611	ITT Rayonier Inc. Port Angeles Pulp Div. - Port Angeles, WA	3,661,010
4	2611, 2631, 2821, 2653	Union Camp Corp. - Savannah, GA	3,499,470
5	2611, 2631	Inland Container Corp. Rome Linerboard Div. - Rome, GA	3,245,815
6	2611, 2621, 2631, 2679	Union Camp Corp. Fine Paper and Building Products Div. - Franklin, VA	3,085,254
7	2621, 2631	Stone Container Corp. Containerboard & Paper Div. - Florence, SC	3,049,918
8	2621	Scott Paper Co. - Mobile, AL	3,009,185
9	2611	CPI Kraft Div. - Wisconsin Rapids, WI	2,881,855
10	2621	Champion International Corp. Courtland Mill - Courtland, AL	2,874,701

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

#### IV.B. Summary of Selected Chemicals Released

The following is a synopsis of current scientific toxicity and fate information for the top chemicals (by weight) that facilities within this sector self-reported as released to the environment based upon 1993 TRI data. Because this section is based upon self-reported release data, it does not attempt to provide information on management practices employed by the sector to reduce the releases of these chemicals. Information regarding pollutant release reductions over time may be available from EPA's TRI and 33/50 programs, or directly from the industrial trade associations that are listed in Section IX of this document. Since these descriptions are

<sup>d</sup> Being included on this list does not mean that the release is associated with non-compliance with environmental laws.

cursory, please consult the sources referenced below for a more detailed description of both the chemicals described in this section, and the chemicals that appear on the full list of TRI chemicals appearing in Section IV.A.

The brief descriptions provided below were taken from the *1993 Toxics Release Inventory Public Data Release* (EPA, 1994), and the Hazardous Substances Data Bank (HSDB), accessed via TOXNET. TOXNET is a computer system run by the National Library of Medicine. It includes a number of toxicological databases managed by EPA, National Cancer Institute, and the National Institute for Occupational Safety and Health.<sup>e</sup> HSDB contains chemical-specific information on manufacturing and use, chemical and physical properties, safety and handling, toxicity and biomedical effects, pharmacology, environmental fate and exposure potential, exposure standards and regulations, monitoring and analysis methods, and additional references. The information contained below is based upon exposure assumptions that have been conducted using standard scientific procedures. The effects listed below must be taken in context of these exposure assumptions that are more fully explained within the full chemical profiles in HSDB. For more information on TOXNET, contact the TOXNET help line at 800-231-3766.

Methanol (CAS: 67-56-1)

**Toxicity.** Methanol is readily absorbed from the gastrointestinal tract and the respiratory tract, and is toxic to humans in moderate to high doses. In the body, methanol is converted into formaldehyde and formic acid. Methanol is excreted as formic acid. Observed toxic effects at high dose levels generally include central nervous system damage and blindness. Long-term exposure to high levels of methanol via inhalation cause liver and blood damage in animals.

Ecologically, methanol is expected to have low toxicity to aquatic organisms. Concentrations lethal to half the organisms of a test population are expected to exceed 1 mg methanol per liter water. Methanol is not likely to persist in water or to bioaccumulate in aquatic organisms.

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<sup>e</sup> Databases included in TOXNET are: CCRIS (Chemical Carcinogenesis Research Information System), DAR T (Developmental and Reproductive Toxicity Database), DBIR (Directory of Biotechnology Information Resources), EMICBACK (Environmental Mutagen Information Center Backfile), GENE-TOX (Genetic Toxicology), HSD B (Hazardous Substances Data Bank), IRIS (Integrated Risk Information System), RTECS (Registry of Toxic Effects of Chemical Substances), and TRI (Toxic Chemical Release Inventory).

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**Carcinogenicity.** There is currently no evidence to suggest that this chemical is carcinogenic.

**Environmental Fate.** Liquid methanol is likely to evaporate when left exposed. Methanol reacts in air to produce formaldehyde which contributes to the formation of air pollutants. In the atmosphere it can react with other atmospheric chemicals or be washed out by rain. Methanol is readily degraded by microorganisms in soils and surface waters.

**Physical Properties.** Methanol is highly flammable.

Hydrochloric Acid(CAS: 7647-01-1)

**Toxicity.** Hydrochloric acid is primarily a concern in its aerosol form. Acid aerosols have been implicated in causing and exacerbating a variety of respiratory ailments. Dermal exposure and ingestion of highly concentrated hydrochloric acid can result in corrosivity.

Ecologically, accidental releases of solution forms of hydrochloric acid may adversely affect aquatic life by including a transient lowering of the pH (i.e., increasing the acidity) of surface waters.

**Carcinogenicity.** There is currently no evidence to suggest that this chemical is carcinogenic.

**Environmental Fate.** Releases of hydrochloric acid to surface waters and soils will be neutralized to an extent due to the buffering capacities of both systems. The extent of these reactions will depend on the characteristics of the specific environment.

**Physical Properties.** Concentrated hydrochloric acid is highly corrosive.

Sulfuric Acid(CAS: 7664-93-9)

**Toxicity.** Concentrated sulfuric acid is corrosive. In its aerosol form, sulfuric acid has been implicated in causing and exacerbating a variety of respiratory ailments.

Ecologically, accidental releases of solution forms of sulfuric acid may adversely affect aquatic life by inducing a transient lowering of the pH (i.e., increasing the acidity) of surface waters. In addition, sulfuric acid in

its aerosol form is also a component of acid rain. Acid rain can cause serious damage to crops and forests.

**Carcinogenicity.** There is currently no evidence to suggest that this chemical is carcinogenic.

**Environmental Fate.** Releases of sulfuric acid to surface waters and soils will be neutralized to an extent due to the buffering capacities of both systems. The extent of these reactions will depend on the characteristics of the specific environment.

In the atmosphere, aerosol forms of sulfuric acid contribute to acid rain. These aerosol forms can travel large distances from the point of release before the acid is deposited on land and surface waters in the form of rain.

*Chloroform* (CAS: 67-66-3)

**Toxicity.** Target organs of chloroform toxicity include the liver, kidneys, heart, eyes, and skin. Short-term exposure to high concentrations of chloroform leads to inebriation and excitation, followed by central nervous system depression, including fainting, dizziness, and anesthesia; gastrointestinal upsets, including nausea, vomiting, and salivation; kidney damage; and liver damage. Exposure to very high concentrations of chloroform may lead to respiratory depression, loss of motor functions, coma, and death due to heart, liver or kidney failure. Long-term exposure to chloroform is associated with liver and kidney damage, and mood changes. Contact with the eyes and skin causes reversible damage.

Populations at special risk from exposure to chloroform include individuals with liver, kidney, or central nervous system damage, and chronic alcoholics.

**Carcinogenicity.** Chloroform is a probable human carcinogen, based on evidence in animals due to both oral and inhalation exposure.

**Environmental Fate.** The majority of chloroform releases to the environment are to the atmosphere; releases to water and land will be primarily lost by evaporation and will also end up in the atmosphere. Atmospheric releases may be transported long distances and will photodegrade with a half-life of a few months. Releases onto the land that do not evaporate will also leach through the soil and persist in the groundwater for a long time. Little chloroform is adsorbed to soil particles. Biodegradation is generally slow.



Chloroform is not expected to bioconcentrate in the food chain, though contamination of food is likely due to its use as an extractant and its presence in drinking water.

Ammonia (CAS: 7664-41-7)

**Toxicity.** Anhydrous ammonia is irritating to the skin, eyes, nose, throat, and upper respiratory system.

Ecologically, ammonia is a source of nitrogen (an essential element for aquatic plant growth), and may therefore contribute to eutrophication of standing or slow-moving surface water, particularly in nitrogen-limited waters such as the Chesapeake Bay. In addition, aqueous ammonia is moderately toxic to aquatic organisms.

**Carcinogenicity.** There is currently no evidence to suggest that this chemical is carcinogenic.

**Environmental Fate.** Ammonia combines with sulfate ions in the atmosphere and is washed out by rainfall, resulting in rapid return of ammonia to the soil and surface waters.

Ammonia is a central compound in the environmental cycling of nitrogen. Ammonia in lakes, rivers, and streams is converted to nitrate.

**Physical Properties.** Ammonia is a corrosive and severely irritating gas with a pungent odor.

#### IV.C. Other Data Sources

The toxic chemical release data obtained from TRI captures the vast majority of facilities in the pulp and paper industry. It also allows for a comparison across years and industry sectors. Reported chemicals are limited, however, to the 316 required by TRI. Some pulp and paper emissions may not be captured by TRI. The EPA Office of Air Quality, Planning, and Standards has compiled air pollutant emission factors for determining the total air emissions of priority pollutants (e.g., total hydrocarbons, SO<sub>x</sub>, NO<sub>x</sub>, CO, particulates, etc.) from many sources.

The Aerometric Information Retrieval System (AIRS) contains a wide range of information related to stationary sources of air pollution, including the emissions of a number of air pollutants which may be of concern within a particular industry. With the exception of volatile

organic compounds (VOCs), there is little overlap with the TRI chemicals reported above. Exhibit 27 summarizes annual releases of carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), particulate matter of 10 microns or less (PM<sub>10</sub>), total particulates (PT), sulfur dioxide (SO<sub>2</sub>), and volatile organic compounds (VOCs).

<b>Exhibit 27: Pollutant Releases (short tons/year)</b>						
<b>Industry Sector</b>	<b>CO</b>	<b>NO<sub>2</sub></b>	<b>PM<sub>10</sub></b>	<b>PT</b>	<b>SO<sub>2</sub></b>	<b>VOC</b>
Metal Mining	5,391	28,583	39,359	140,052	84,222	1,283
Nonmetal Mining	4,525	28,804	59,305	167,948	24,129	1,736
Lumber and Wood Production	123,756	42,658	14,135	63,761	9,419	41,423
Furniture and Fixtures	2,069	2,981	2,165	3,178	1,606	59,426
<b>Pulp and Paper</b>	<b>624,291</b>	<b>394,448</b>	<b>35,579</b>	<b>113,571</b>	<b>541,002</b>	<b>96,875</b>
Printing	8,463	4,915	399	1,031	1,728	101,537
Inorganic Chemicals	166,147	103,575	4,107	39,062	182,189	52,091
Organic Chemicals	146,947	236,826	26,493	44,860	132,459	201,888
Petroleum Refining	419,311	380,641	18,787	36,877	648,155	369,058
Rubber and Misc. Plastics	2,090	11,914	2,407	5,355	29,364	140,741
Stone, Clay and Concrete	58,043	338,482	74,623	171,853	339,216	30,262
Iron and Steel	1,518,642	138,985	42,368	83,017	238,268	82,292
Nonferrous Metals	448,758	55,658	20,074	22,490	373,007	27,375
Fabricated Metals	3,851	16,424	1,185	3,136	4,019	102,186
Computer and Office	24	0	0	0	0	0
Electronics and Other Electrical	367	1,129	207	293	453	4,854
Motor Vehicles, Bodies, Parts	35,303	23,725	2,406	12,853	25,462	101,275
Dry Cleaning	101	179	3	28	152	7,310
Source: U.S. EPA Office of Air and Radiation, AIRS Database, May 1995.						

#### IV.D. Comparison of Toxic Release Inventory Between Selected Industries

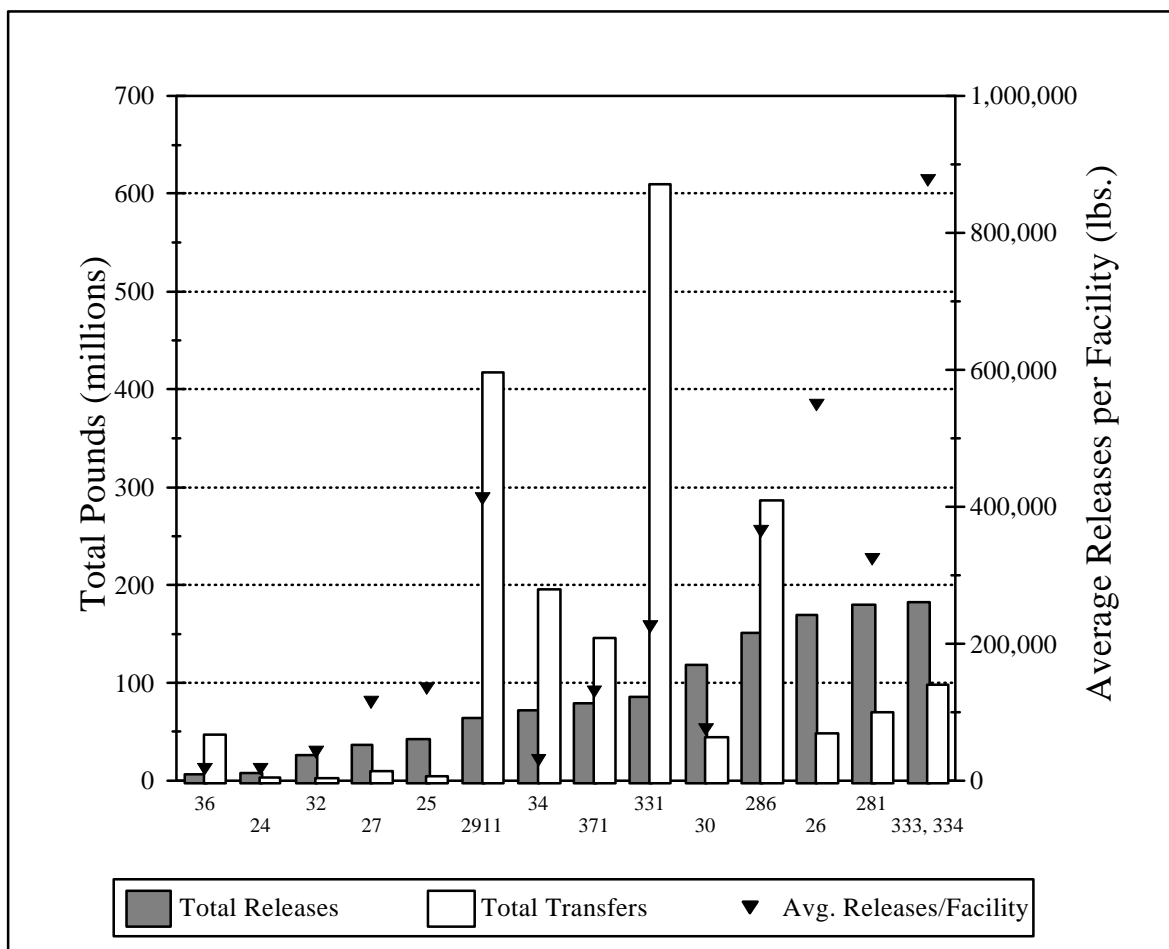
The following information is presented as a comparison of pollutant release and transfer data across industrial categories. It is provided to give a general sense as to the relative scale of releases and transfers within each sector profiled under this project. Please note that the following figure and table do not contain releases and transfers for industrial categories that are not included in this project, and thus cannot be used to draw conclusions regarding the total release and transfer amounts that are reported to TRI.



Similar information is available within the annual TRI Public Data Release Book.

Exhibit 28 is a graphical representation of a summary of the 1993 TRI data for the Pulp and Paper industry and the other sectors profiled in separate notebooks. The bar graph presents the total TRI releases and total transfers on the left axis and the triangle points show the average releases per facility on the right axis. Industry sectors are presented in the order of increasing total TRI releases. The graph is based on the data shown in Exhibit 29 and is meant to facilitate comparisons between the relative amounts of releases, transfers, and releases per facility both within and between these sectors. The reader should note, however, that differences in the proportion of facilities captured by TRI exist between industry sectors. This can be a factor of poor SIC matching and relative differences in the number of facilities reporting to TRI from the various sectors. In the case of Pulp and Paper industry the 1993 TRI data presented here covers 309 facilities. These facilities listed SIC 2611-2631 (Pulp, Paper, and Paperboard Mills) as primary SIC codes.

**Exhibit 28: Summary of 1993 TRI Data:  
Releases and Transfers by Industry**



SIC Range	Industry Sector	SIC Range	Industry Sector	SIC Range	Industry Sector
36	Electronic Equipment and Components	2911	Petroleum Refining	286	Organic Chemical Mfg.
24	Lumber and Wood Products	34	Fabricated Metals	26	Pulp and Paper
32	Stone, Clay, and Concrete	371	Motor Vehicles, Bodies, Parts, and Accessories	281	Inorganic Chemical Mfg.
27	Printing	331	Iron and Steel	333,334	Nonferrous Metals
25	Wood Furniture and Fixtures	30	Rubber and Misc. Plastics		

Exhibit 29: Toxics Release Inventory Data for Selected Industries

Industry Sector	SIC Range	# TRI Facilities	1993 TRI Releases		1993 TRI Transfers		Total Releases + Transfers (million lbs.)	Average Releases + Transfers per Facility (pounds)
			Total Releases (million lbs.)	Average Releases per Facility (pounds)	Total Transfers (million lbs.)	Average Transfers per Facility (pounds)		
Stone, Clay, and Concrete	32	634	26.6	42,000	2.2	4,000	28.8	46,000
Lumber and Wood Products	24	491	8.4	17,000	3.5	7,000	11.9	24,000
Furniture and Fixtures	25	313	42.2	135,000	4.2	13,000	46.4	148,000
Printing	2711-2789	318	36.5	115,000	10.2	32,000	46.7	147,000
Electronic Equip. and Components	36	406	6.7	17,000	47.1	116,000	53.7	133,000
Rubber and Misc. Plastics	30	1,579	118.4	75,000	45	29,000	163.4	104,000
Motor Vehicles, Bodies, Parts, and Accessories	371	609	79.3	130,000	145.5	239,000	224.8	369,000
Pulp and Paper	2611-2631	309	169.7	549,000	48.4	157,000	218.1	706,000
Inorganic Chem. Mfg.	2812-2819	555	179.6	324,000	70	126,000	249.7	450,000
Petroleum Refining	2911	156	64.3	412,000	417.5	2,676,000	481.9	3,088,000
Fabricated Metals	34	2,363	72	30,000	195.7	83,000	267.7	123,000
Iron and Steel	331	381	85.8	225,000	609.5	1,600,000	695.3	1,825,000
Nonferrous Metals	333, 334	208	182.5	877,000	98.2	472,000	280.7	1,349,000
Organic Chemical Mfg.	2861-2869	417	151.6	364,000	286.7	688,000	438.4	1,052,000
Metal Mining	10	Industry sector not subject to TRI reporting.						
Nonmetal Mining	14	Industry sector not subject to TRI reporting.						
Dry Cleaning	7216	Industry sector not subject to TRI reporting.						

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

## V. POLLUTION PREVENTION OPPORTUNITIES

The best way to reduce pollution is to prevent it in the first place. Industries have creatively implemented pollution prevention techniques that improve efficiency and increase profits while at the same time minimizing environmental impacts. This can be done in many ways such as reducing material inputs, re-engineering processes to reuse by-products, improving management practices, and employing substitution of toxic chemicals. Some smaller facilities are able to actually get below regulatory thresholds just by reducing pollutant releases through aggressive pollution prevention policies.

In order to encourage these approaches, this section provides both general and company-specific descriptions of some pollution prevention advances that have been implemented within the pulp and paper industry. While the list is not exhaustive, it does provide core information that can be used as the starting point for facilities interested in beginning their own pollution prevention projects. When possible, this section provides information from real activities that can, or are being implemented by this sector -- including a discussion of associated costs, time frames, and expected rates of return. This section provides summary information from activities that may be, or are being implemented by this sector. When possible, information is provided that gives the context in which the technique can be effectively used. Please note that the activities described in this section do not necessarily apply to all facilities that fall within this sector. Facility-specific conditions must be carefully considered when pollution prevention options are evaluated, and the full impacts of the change must examine how each option affects air, land and water pollutant releases.

### Pollution Prevention Opportunities for the Pulp and Paper Industry

The chemical recovery systems used in chemical pulping processes are an example of pollution prevention technologies that have evolved alongside process technologies. An efficient chemical recovery system is a crucial component of chemical pulping mill operation: the chemical recovery process regenerates process chemicals, reducing natural resource usage and associated costs, as well as discharges to the environment and producing energy. Many recent pollution prevention efforts in the pulp and paper industry have focused on reducing the releases of toxics, in particular, chlorinated compounds. Pollution prevention techniques have proven to be more effective in controlling these pollutants than conventional control and treatment technologies. Most conventional, end-of-pipe treatment technologies are not effective in destroying many chlorinated compounds and often merely transfer the pollutants to another

environmental medium. Efforts to prevent chlorinated releases have, therefore, focused on source reduction and material substitution techniques such as defoamers, bleaching chemical or wood chip substitution to reduce the industry's use and releases of chlorinated compounds. Such source reduction efforts and material substitutions usually require substantial changes in the production process. In addition to the major process changes aimed at reducing toxics releases, the industry is implementing a number of pollution prevention techniques to reduce water use and pollutant releases (BOD, COD, and TSS) such as: dry debarking, recycling of log flume water, improved spill control, bleach filtrate recycle, closed screen rooms, and improved storm water management. The pulp and paper industry has also worked to increase the amount of secondary and recycled fibers used for the pulping process. According to industry sources, the pulp and paper industry set and met a 1995 goal of 40 percent recycling and reuse of all paper consumed in the U.S. Currently, the industry has set a new goal of recovering 50 percent of all paper consumed in the U.S. for recycle and reuse by the year 2000. These figures should be compared with the utilization rate of secondary fibers (secondary fibers as a percentage of the total fibers used to make pulp) which is at approximately 30 percent and is climbing slowly.<sup>29</sup> Current secondary fiber utilization rates in resource deficient countries such as Japan are close to 50 percent.

Because the pulp and paper industry is highly capital intensive and uses long-established technologies with long equipment lifetimes, major process-changing pollution prevention opportunities are expensive and require long time periods to implement. The pulp and paper industry is a dynamic one, however, that constantly makes process changes and material substitutions to increase productivity and cut costs. The industry is moving towards pollution prevention as illustrated by the above average percentage of facilities in the industry (43.1 percent) reporting pollution prevention activities to TRI and the above average participation in the 33/50 Program (25 percent) to reduce toxic chemicals releases (See Section \III.C.1). The trend towards materials substitutions is also reflected in an increasing demand for alternative pulping and bleaching chemicals.

One of the factors that will drive the industry towards pollution prevention much more rapidly in the future are the proposed integrated NESHAP and effluent limitation guidelines for the pulp and paper industry. (See Section I.E. - Future Regulatory Requirements.) These regulations are being developed together in part to reduce the costs of compliance, to emphasize the multi-media nature of pollution control, and to promote pollution

prevention. Many of the proposed technology-based effluent limitation guidelines for the control of toxic releases consist of process changes that will substitute chlorine dioxide for elemental chlorine and that completely eliminate elemental chlorine in bleaching processes. The NESHAP standards also allow Hazardous Air Pollutant (HAP) reductions through recycling of wastewater streams to a process unit and routing pulping emissions to a boiler, lime kiln, or recovery furnace.

Brief descriptions of some of pollution prevention techniques found to be effective at pulp and paper facilities are provided below. For more detail on the pollution prevention options listed below and for descriptions of additional alternative pulping and bleaching processes refer to the Office of Pollution Prevention and Toxics' 1993 report, *Pollution Prevention Technologies for the Bleached Kraft Segment of the U.S. Pulp and Paper Industry* and other pollution prevention/waste minimization documents listed in Resource Materials section. It should be noted that although many of the pollution prevention opportunities listed below are primarily aimed at reducing toxics releases, the process changes can often lead to reductions in the conventional pollutants such as BOD<sub>5</sub> and TSS as well as COD, AOX, and contribute to reduced water use, sludge volumes generated, and air emissions.

**Extended Delignification.** Extended delignification further reduces the lignin content of the pulp before it moves to the bleach plant. Because the amount of bleaching chemicals required to achieve a certain paper brightness is proportional to the amount of lignin remaining in the pulp after the pulping process, extended delignification can reduce the amounts of bleaching chemicals needed. A number of different extended delignification processes have been developed. These processes involve: increasing the cooking time; adding the cooking chemicals at several points throughout the cooking process; regulating the cooking temperatures; and carefully controlling the concentration of hydrogen sulfide ions and dissolved lignin. Importantly, the process changes do not degrade the cellulose which would normally accompany increased cooking time. Extended delignification processes have been developed for both batch and continuous pulping processes. The lignin content of the brownstock pulp has been reduced by between 20 and 50 percent with no losses in pulp yield or strength using such processes. In consequence, chlorinated compounds generated during bleaching are reduced in approximate proportion to reductions in the brownstock lignin content. In addition, the same changes have resulted in significant reductions in BOD<sub>5</sub>, COD and color. One study demonstrated a 29 percent decrease in BOD<sub>5</sub> resulting from an extended delignification process. Facility energy

requirements have been shown to increase slightly with extended delignification. However, off-site power requirements (associated with decreased chemical use) have been estimated to more than offset the on-site increases. As of 1993, extended delignification accounted for 20 percent of worldwide bleached kraft capacity and 21 percent of U.S. mills. A significant number of changeovers to the process are currently underway.

**Oxygen Delignification.** Oxygen delignification also reduces the lignin content in the pulp. The process involves the addition of an oxygen reactor between the kraft pulping stages and the bleach plant. The brownstock pulp from the digester is first washed and then mixed with sodium hydroxide or oxidized cooking liquor. The pulp is fluffed, deposited in the oxygen reactor, steam heated, and injected with gaseous oxygen wherein it undergoes oxidative delignification. The pulp is then washed again to remove the dissolved lignin before moving to the bleaching plant. Oxygen delignification can reduce the lignin content in the pulp by as much as 50 percent resulting in a potentially similar reduction in the use of chlorinated bleaching chemicals and chlorinated compound pollutants. The process can be used in combination with other process modifications that can completely eliminate the need for chlorine-based bleaching agents. In addition, unlike bleach plant filtrate, the effluent from the oxygen reactor can be recycled through the pulp mill recovery cycle, further reducing the non-pulp solids going to the bleaching plant and the effluent load from the bleach plant. The net effect is reduced effluent flows and less sludge generation. Facility energy requirements have been shown to increase with oxygen delignification, however, the decrease in off-site power requirements (associated with decreased chemical use) have been estimated to exceed the on-site increases resulting in a decrease in overall energy requirements. Also, the recovered energy and reduced chemical use offset the cost. As of 1993, oxygen delignification projects have been installed or were planned for 27 U.S. pulp and paper mills, accounting for more than 40 percent of bleach kraft pulp production.

**Ozone Delignification.** As a result of a considerable research effort, ozone delignification (ozone bleaching) is now being used in the pulp and paper industry. The technology has the potential to eliminate the need for chlorine in the bleaching process. Ozone delignification is performed using processes and equipment similar to that of oxygen delignification. The ozone process, however, must take place at a very low pH (1.0 to 2.0), requiring the addition of sulfuric acid to the pulp prior to the ozonation. In addition to low pH, a number of process conditions are critical for ozone

delignification: organic materials must be almost completely washed out of the brownstock pulp; temperatures must stay at about 20 °C; and ozone reactive metals must be removed prior to the ozonation stage. Oxygen delignification and/or extended delignification processes are considered a prerequisite for successful ozone bleaching. When used in combination, the two processes can result in a high quality bright pulp that requires little or no chlorine or chlorine dioxide bleaching. Overall emissions from the combination of the oxygen and ozone processes are substantially lower than conventional processes because effluents from each stage can be recycled. Pilot systems consisting of ozone delignification in combination with oxygen delignification and oxygen extraction have shown reductions in BOD<sub>5</sub> of 62 percent, COD of 53 percent, color of 88 percent, and organic chlorine compounds of 98 percent. However, ozone is unstable and will decompose to molecular oxygen, thus ozone must be generated on-site and fed immediately to the pulp reactor. Ozone generation systems are complex and account for a high percentage of the total costs. Facility energy use will increase due to the on-site production of ozone, however, this energy will be offset by the energy that would normally be used to produce chlorine and chlorine dioxide.

**Anthraquinone Catalysis.** The addition of anthraquinone (a chemical catalyst produced from coal tar) to the pulping liquor has been shown to speed up the kraft pulping reaction and increase yield by protecting cellulose fibers from degradation. The anthraquinone accelerates the fragmentation of lignin, allowing it to be broken down more quickly by the pulping chemicals. This lowers the amount of lignin in the prechlorination pulp, thus reducing the amount of bleaching chemicals needed. Anthraquinone catalysts are increasingly used in combination with oxygen delignification and extended delignification to overcome boiler capacity bottlenecks arising from these delignification processes.

**Black Liquor Spill Control and Prevention.** The mixture of dissolved lignin and cooking liquor effluent from the pulping reactor and washed pulp is known as black liquor. Raw black liquor contains high levels of BOD, COD, and organic compounds. Spills of black liquor can result from overflows, leaks from process equipment, or from deliberate dumping by operators to avoid a more serious accident. Spills of black liquor can have impacts on receiving waters, are a source of air emissions, and can shock the microbial action of wastewater treatment systems. Black liquor losses also result in the loss of the chemical and heat value of the material. Systems needed to control black liquor spills are a combination of good design, engineering, and, most importantly, operator training. A few elements of an effective spill control system include: physical isolation of



pieces of equipment; floor drainage systems that allow spills to be collected; backup black liquor storage capacity; sensors that provide immediate warning of potential or actual spills; and enclosed washing and screening equipment.

**Enzyme Treatment of Pulp.** Biotechnology research has resulted in the identification of a number of microorganisms that produce enzymes capable of breaking down lignin in pulp. Although the technology is new, it is believed that a number of mills are currently conducting enzyme treatment trials. The microorganisms capable of producing the necessary enzymes are called xylanases. Xylanases for pulp bleaching trials are available from several biotechnology and chemical companies. Since enzymes are used as a substitute for chemicals in bleaching pulp, their use will result in a decrease in chlorinated compounds released somewhat proportional to the reduction in bleaching chemicals used. Enzymes are also being used to assist in the deinking of secondary fiber. Research at the Oak Ridge National Laboratories has identified cellulase enzymes that will bind ink to the smaller fiber particles facilitating recovery of the ink sludge. Use of enzymes may also reduce the energy costs and chemical use in retrieving ink sludge from deinking effluent.

**Improved Brownstock and Bleaching Stage Washing.** Liquor solids remaining in the brownstock pulp are carried over to the bleach plant and then compete with the remaining lignin in the pulp for reaction with the bleaching chemicals. Improved washing, therefore, can reduce the required amount of bleaching chemicals and the subsequent reductions in chlorinated compounds as well as conventional pollutants. Modern washing systems with improved solids removal and energy efficiency are beginning to replace the conventional rotary vacuum washers. State-of-the-art washing systems include: atmospheric or pressure diffusion washers, belt washers, and pulp presses. Opportunities for reduced effluent flows and water use are also present in the bleaching plant. Acid filtrates from hypochlorite or chlorine dioxide stages can be used as dilution and wash water for the first bleaching stage. Similarly, second extraction stage filtrates can be used as dilution and wash water in the first extraction stage. Most new mills are designed with these counter-current washing systems and some mills are retrofitting their existing wash systems.

**Chlorine Dioxide Substitution.** The substitution of chlorine dioxide for elemental chlorine as a bleaching agent is gaining widespread use due to its beneficial impacts on pulp and effluent quality. The use of chlorine dioxide in place of chlorine increases the proportion of oxidative reactions

thereby reducing the formation of residual chlorinated organic pollutants. Chlorine dioxide bleaching produces about 20 percent of the chlorinated compounds produced using elemental chlorine. A substitution of 50 to 70 percent in the first bleaching stage has become relatively common in recent years. Chlorine dioxide substitutions approaching 100 percent have been shown to increase pulp yields and quality. The use of chlorine dioxide, however, is two to four times more expensive than the equivalent oxidizing power using elemental chlorine. Because chlorine dioxide is unstable and cannot be stored, it must be continually generated at the mill. The processes used to manufacture chlorine dioxide generate a number of byproducts that may have environmental impacts, including, spent acids, chlorine gas, salt cakes and acid cakes. A number of alternative chlorine dioxide generation processes are being developed to reduce or eliminate the formation of such byproducts.

**Split Addition of Chlorine/Improved pH Control.** Although these process modifications are not widespread throughout the industry (currently in practice at 11 mills), one company has reported notable results. Reducing the chlorine concentration during the bleaching process by adding elemental chlorine in incremental charges has been shown to reduce the formation of unwanted chlorinated organic compounds. A high pH in the chlorination stage is also known to reduce the formation of chlorinated organic compounds, but normally this also results in a decreased pulp yield. A high pH, in combination with split chlorine addition, however, has been observed to reduce the formation of chlorinated compounds without a loss of yield. It was reported that by using split chlorine addition, the generation of certain dioxin and furan molecules were reduced by up to 70 percent. With the addition of pH control these discharges reportedly fell by 90 percent. However, consistency in reduction of chlorinated organic pollutants has been problematic.

**Improved Chipping and Screening.** The size and thickness of wood chips is critical for proper circulation and penetration of the pulping chemicals. Chip uniformity is controlled by the chipper and screens that remove under and oversized pieces. Standard equipment normally does not sort chips by thickness although it has been demonstrated that chip thickness is extremely important in determining the lignin content of pulp. Improper chip thicknesses can therefore result in increased use of bleaching chemicals and the associated chlorinated compounds and conventional pollutants. Some mills are beginning to incorporate equipment that will separate chips according to their thickness as well as by length and width.

**Oxygen-Reinforced/Peroxide Extraction.** Oxygen-reinforced extraction (or oxidative extraction) and peroxide-reinforced extraction processes used separately or together have been shown to reduce the amount of elemental chlorine and chlorine dioxide needed in the bleaching process while increasing the pulp brightness. Gaseous elemental oxygen (in the case of oxygen-reinforced extraction) and aqueous hydrogen peroxide (in the case of peroxide extraction) are used as a part of the first alkaline extraction stage to facilitate the solubilization and removal of chlorinated and oxidized lignin molecules. Oxygen-reinforced extraction has seen widespread adoption by the industry in recent years. It is estimated that up to 80 percent of mills in the U.S. are using oxygen-reinforced extraction. The use of peroxide extraction is also increasing. As of 1987, it was estimated that 25 percent of domestic mills were using peroxide extraction. As of 1993, EPA estimates that approximately 70 percent of domestic mills practice some type of enhanced extraction process.

**Improved Chemical Controls and Mixing.** The formation of chlorinated organics can be minimized by avoiding excess concentrations of chlorine-based bleaching chemicals within reactor vessels. This can be accomplished by carefully controlling the chemical application rates and by ensuring proper mixing of chemicals within the reactor. Modern chemical application control and monitoring systems and high-shear mixers have been developed which decrease formation of chlorinated organic compounds.



## VI. SUMMARY OF APPLICABLE FEDERAL STATUTES AND REGULATIONS

This section discusses the Federal statutes and regulations that may apply to this sector. The purpose of this section is to highlight, and briefly describe the applicable Federal requirements, and to provide citations for more detailed information. The three following sections are included.

- Section VI.A. contains a general overview of major statutes
- Section VI.B. contains a list of regulations specific to this industry
- Section VI.C. contains a list of pending and proposed regulations

The descriptions within Section VI are intended solely for general information. Depending upon the nature or scope of the activities at a particular facility, these summaries may or may not necessarily describe all applicable environmental requirements. Moreover, they do not constitute formal interpretations or clarifications of the statutes and regulations. For further information, readers should consult the Code of Federal Regulations and other state or local regulatory agencies. EPA Hotline contacts are also provided for each major statute.

### VI.A. General Description of Major Statutes

#### *Resource Conservation and Recovery Act (RCRA)*

The Resource Conservation And Recovery Act (RCRA) of 1976, which amended the Solid Waste Disposal Act, addresses solid (Subtitle D) and hazardous (Subtitle C) waste management activities. The Hazardous and Solid Waste Amendments (HSWA) of 1984 strengthened RCRA's hazardous waste management provisions and added Subtitle I, which governs underground storage tanks (USTs).

Regulations promulgated pursuant to Subtitle C of RCRA (40 CFR Parts 260-299) establish a "cradle-to-grave" system governing hazardous waste from the point of generation to disposal. RCRA hazardous wastes include the specific materials listed in the regulations (commercial chemical products, designated with the code "P" or "U"; hazardous wastes from specific industries/sources, designated with the code "K"; or hazardous wastes from non-specific sources, designated with the code "F") and materials which exhibit a hazardous waste characteristic (ignitability, corrosivity, reactivity, or toxicity and designated with the code "D").

Regulated entities that generate hazardous waste are subject to waste accumulation, manifesting, and record keeping standards. Facilities that treat, store, or dispose of hazardous waste must obtain a permit, either from EPA or from a State agency which EPA has authorized to implement the permitting program. Subtitle C permits contain general facility standards such as contingency plans, emergency procedures, record keeping and reporting requirements, financial assurance mechanisms, and unit-specific standards. RCRA also contains provisions (40 CFR Part 264, Subpart S and §264.10) for conducting corrective actions which govern the cleanup of releases of hazardous waste or constituents from solid waste management units at RCRA-regulated facilities.

Although RCRA is a Federal statute, many States implement the RCRA program. Currently, EPA has delegated its authority to implement various provisions of RCRA to 46 of the 50 States.

Most RCRA requirements are not industry specific but apply to any company that transports, treats, stores, or disposes of hazardous waste. Here are some important RCRA regulatory requirements:

- **Identification of Hazardous Wastes** (40 CFR Part 261) lays out the procedure every generator should follow to determine whether the material created is considered a hazardous waste, solid waste, or is exempted from regulation.
- **Standards for Generators of Hazardous Waste** (40 CFR Part 262) establishes the responsibilities of hazardous waste generators including obtaining an ID number, preparing a manifest, ensuring proper packaging and labeling, meeting standards for waste accumulation units, and record keeping and reporting requirements. Generators can accumulate hazardous waste for up to 90 days (or 180 days depending on the amount of waste generated) without obtaining a permit.
- **Land Disposal Restrictions** (LDRs) are regulations prohibiting the disposal of hazardous waste on land without prior treatment. Under the LDRs (40 CFR Part 268), materials must meet land disposal restriction (LDR) treatment standards prior to placement in a RCRA land disposal unit (landfill, land treatment unit, waste pile, or surface impoundment). Wastes subject to the LDRs include solvents, electroplating wastes, heavy metals, and acids. Generators of waste subject to the LDRs must provide notification

of such to the designated TSD facility to ensure proper treatment prior to disposal.

- **Used Oil Management Standards** (40 CFR Part 279) impose management requirements affecting the storage, transportation, burning, processing, and re-refining of the used oil. For parties that merely generate used oil, regulations establish storage standards. For a party considered a used oil marketer (one who generates and sells off-specification used oil directly to a used oil burner), additional tracking and paperwork requirements must be satisfied.
- **Tanks and Containers** used to store hazardous waste with a high volatile organic concentration must meet emission standards under RCRA. Regulations (40 CFR Part 264-265, Subpart CC) require generators to test the waste to determine the concentration of the waste, to satisfy tank and container emissions standards, and to inspect and monitor regulated units. These regulations apply to all facilities who store such waste, including generators operating under the 90-day accumulation rule.
- **Underground Storage Tanks** (USTs) containing petroleum and CERCLA hazardous substance are regulated under Subtitle I of RCRA. Subtitle I regulations (40 CFR Part 280) contain tank design and release detection requirements, as well as financial responsibility and corrective action standards for USTs. The UST program also establishes increasingly stringent standards, including upgrade requirements for existing tanks, that must be met by 1998.
- **Boilers and Industrial Furnaces** (BIFs) that use or burn fuel containing hazardous waste must comply with strict design and operating standards. BIF regulations (40 CFR Part 266, Subpart H) address unit design, provide performance standards, require emissions monitoring, and restrict the type of waste that may be burned.

*EPA's RCRA/Superfund/UST Hotline, at (800) 424-9346, responds to questions and distributes guidance regarding all RCRA regulations. The RCRA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., ET excluding Federal holidays.*

*Comprehensive Environmental Response, Compensation, And Liability Act (CERCLA)*

CERCLA, a 1980 law commonly known as Superfund, authorizes EPA to respond to releases, or threatened releases, of hazardous substances that may present an imminent and substantial endangerment to public health, welfare, or the environment. CERCLA also enables EPA to force parties responsible for environmental contamination to clean it up or to reimburse the Superfund for response costs incurred by EPA. The Superfund Amendments and Reauthorization Act (SARA) of 1986 revised various sections of CERCLA, extended the taxing authority for the Superfund, and created a free-standing law, SARA Title III, also known as the Emergency Planning and Community Right-to-Know Act (EPCRA).

The CERCLA **hazardous substance release reporting regulations** (40 CFR Part 302) direct the person in charge of a facility to report to the National Response Center (NRC) any environmental release of a hazardous substance which exceeds a reportable quantity. Reportable quantities are defined and listed in 40 CFR §302.4. A release report may trigger a response by EPA or by one or more Federal or State emergency response authorities.

EPA implements **hazardous substance responses** according to procedures outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). The NCP includes provisions for permanent cleanups, known as remedial actions, and other cleanups referred to as "removals." EPA generally takes remedial actions only at sites on the National Priorities List (NPL), which currently includes approximately 1,300 sites. Both EPA and states can act at other sites; however, EPA provides responsible parties the opportunity to conduct removal and remedial actions and encourages community involvement throughout the Superfund response process.

*EPA's RCRA/Superfund/UST Hotline, at (800) 424-9346, answers questions and references guidance pertaining to the Superfund program. The CERCLA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., ET, excluding Federal holidays.*

#### *Emergency Planning And Community Right-To-Know Act (EPCRA)*

The Superfund Amendments and Reauthorization Act (SARA) of 1986 created EPCRA, also known as SARA Title III, a statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by State and local governments. EPCRA required the establishment of State emergency response commissions (SERCs), responsible for coordinating



certain emergency response activities and for appointing local emergency planning committees (LEPCs).

EPCRA and the EPCRA regulations (40 CFR Parts 350-372) establish four types of reporting obligations for facilities which store or manage specified chemicals:

- **EPCRA §302** requires facilities to notify the SERC and LEPC of the presence of any "extremely hazardous substance" (the list of such substances is in 40 CFR Part 355, Appendices A and B) if it has such substance in excess of the substance's threshold planning quantity, and directs the facility to appoint an emergency response coordinator.
- **EPCRA §304** requires the facility to notify the SERC and the LEPC in the event of a non-exempt release exceeding the reportable quantity of a CERCLA hazardous substance or an EPCRA extremely hazardous substance.
- **EPCRA §311 and §312** require a facility at which a hazardous chemical, as defined by the Occupational Safety and Health Act, is present in an amount exceeding a specified threshold of chemical use to submit to the SERC, LEPC and local fire department material safety data sheets (MSDSs) or lists of MSDS's and hazardous chemical inventory forms (also known as Tier I and II forms). This information helps the local government respond in the event of a spill or release of the chemical.
- **EPCRA §313** requires manufacturing facilities included in SIC codes 20 through 39, which have ten or more employees, and which manufacture, process, or use specified chemicals in amounts greater than threshold quantities, to submit an annual toxic chemical release report. This report, commonly known as the Form R, covers releases and transfers of toxic chemicals to various facilities and environmental media, and allows EPA to compile the national Toxic Release Inventory (TRI) database.

All information submitted pursuant to EPCRA regulations is publicly accessible, unless protected by a trade secret claim.

*EPA's EPCRA Hotline, at (800) 535-0202, answers questions and distributes guidance regarding the emergency planning and community*

*right-to-know regulations. The EPCRA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., ET, excluding Federal holidays.*

### *Clean Water Act (CWA)*

The primary objective of the Federal Water Pollution Control Act, commonly referred to as the CWA, is to restore and maintain the chemical, physical, and biological integrity of the nation's surface waters. Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants; "conventional" pollutants, such as biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform, oil and grease, and pH; and "non-conventional" pollutants, including any pollutant not identified as either conventional or priority.

The CWA regulates both direct and indirect discharges. The **National Pollutant Discharge Elimination System (NPDES)** program (CWA §402) controls direct discharges into navigable waters. Direct discharges or "point source" discharges are from sources such as pipes and sewers. NPDES permits, issued by either EPA or an authorized State (EPA has presently authorized forty States to administer the NPDES program), contain industry-specific, technology-based and/or water quality-based limits, and establish pollutant monitoring reporting requirements. A facility that intends to discharge into the nation's waters must obtain a permit prior to initiating a discharge. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. The permit will then set forth the conditions and effluent limitations under which a facility may make a discharge.

A NPDES permit may also include discharge limits based on Federal or State water quality criteria or standards, that were designed to protect designated uses of surface waters, such as supporting aquatic life or recreation. These standards, unlike the technological standards, generally do not take into account technological feasibility or costs. Water quality criteria and standards vary from State to State, and site to site, depending on the use classification of the receiving body of water. Most States follow EPA guidelines which propose aquatic life and human health criteria for many of the 126 priority pollutants.

### Storm Water Discharges

In 1987 the CWA was amended to require EPA to establish a program to address **storm water discharges**. In response, EPA promulgated the NPDES storm water permit application regulations. Stormwater discharge

associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing or raw material storage areas at an industrial plant (40 CFR 122.26(b)(14)). These regulations require that facilities with the following storm water discharges apply for an NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal storm sewer system; or (3) a discharge which EPA or the State determines to contribute to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.

The term "storm water discharge associated with industrial activity" means a storm water discharge from one of 11 categories of industrial activity defined at 40 CFR 122.26. Six of the categories are defined by SIC codes while the other five are identified through narrative descriptions of the regulated industrial activity. If the primary SIC code of the facility is one of those identified in the regulations, the facility is subject to the storm water permit application requirements. If any activity at a facility is covered by one of the five narrative categories, storm water discharges from those areas where the activities occur are subject to storm water discharge permit application requirements.

Those facilities/activities that are subject to storm water discharge permit application requirements are identified below. To determine whether a particular facility falls within one of these categories, the regulation should be consulted.

**Category i:** Facilities subject to storm water effluent guidelines, new source performance standards, or toxic pollutant effluent standards.

**Category ii:** Facilities classified as SIC 24-lumber and wood products (except wood kitchen cabinets); SIC 26-paper and allied products (except paperboard containers and products); SIC 28-chemicals and allied products (except drugs and paints); SIC 291-petroleum refining; and SIC 311-leather tanning and finishing.

**Category iii:** Facilities classified as SIC 10-metal mining; SIC 12-coal mining; SIC 13-oil and gas extraction; and SIC 14-nonmetallic mineral mining.

**Category iv:** Hazardous waste treatment, storage, or disposal facilities.

**Category v:** Landfills, land application sites, and open dumps that receive or have received industrial wastes.

**Category vi:** Facilities classified as SIC 5015-used motor vehicle parts; and SIC 5093-automotive scrap and waste material recycling facilities.

**Category vii:** Steam electric power generating facilities.

**Category viii:** Facilities classified as SIC 40-railroad transportation; SIC 41-local passenger transportation; SIC 42-trucking and warehousing (except public warehousing and storage); SIC 43-U.S. Postal Service; SIC 44-water transportation; SIC 45-transportation by air; and SIC 5171-petroleum bulk storage stations and terminals.

**Category ix:** Sewage treatment works.

**Category x:** Construction activities except operations that result in the disturbance of less than five acres of total land area.

**Category xi:** Facilities classified as SIC 20-food and kindred products; SIC 21-tobacco products; SIC 22-textile mill products; SIC 23-apparel related products; SIC 2434-wood kitchen cabinets manufacturing; SIC 25-furniture and fixtures; SIC 265-paperboard containers and boxes; SIC 267-converted paper and paperboard products; SIC 27-printing, publishing, and allied industries; SIC 283-drugs; SIC 285-paints, varnishes, lacquer, enamels, and allied products; SIC 30-rubber and plastics; SIC 31-leather and leather products (except leather and tanning and finishing); SIC 323-glass products; SIC 34-fabricated metal products (except fabricated structural metal); SIC 35-industrial and commercial machinery and computer equipment; SIC 36-electronic and other electrical equipment and components; SIC 37-transportation equipment (except ship and boat building and repairing); SIC 38-measuring, analyzing, and controlling instruments; SIC 39-miscellaneous manufacturing industries; and SIC 4221-4225-public warehousing and storage.

#### Pretreatment Program

Another type of discharge that is regulated by the CWA is one that goes to a publicly-owned treatment works (POTWs). The national **pretreatment program** (CWA §307(b)) controls the indirect discharge of pollutants to POTWs by "industrial users." Facilities regulated under §307(b) must meet certain pretreatment standards. The goal of the pretreatment program is to protect municipal wastewater treatment plants from damage that may occur when hazardous, toxic, or other wastes are

discharged into a sewer system and to protect the toxicity characteristics of sludge generated by these plants. Discharges to a POTW are regulated primarily by the POTW itself, rather than the State or EPA.

EPA has developed general pretreatment standards and technology-based standards for industrial users of POTWs in many industrial categories. Different standards may apply to existing and new sources within each category. "Categorical" pretreatment standards applicable to an industry on a nationwide basis are developed by EPA. In addition, another kind of pretreatment standard, "local limits," are developed by the POTW in order to assist the POTW in achieving the effluent limitations in its NPDES permit.

Regardless of whether a State is authorized to implement either the NPDES or the pretreatment program, if it develops its own program, it may enforce requirements more stringent than Federal standards.

*EPA's Office of Water, at (202) 260-5700, will direct callers with questions about the CWA to the appropriate EPA office. EPA also maintains a bibliographic database of Office of Water publications which can be accessed through the Ground Water and Drinking Water resource center, at (202) 260-7786.*

*Safe Drinking Water Act (SDWA)*

The SDWA mandates that EPA establish regulations to protect human health from contaminants in drinking water. The law authorizes EPA to develop national drinking water standards and to create a joint Federal-State system to ensure compliance with these standards. The SDWA also directs EPA to protect underground sources of drinking water through the control of underground injection of liquid wastes.

EPA has developed primary and secondary drinking water standards under its SDWA authority. EPA and authorized States enforce the primary drinking water standards, which are, contaminant-specific concentration limits that apply to certain public drinking water supplies. Primary drinking water standards consist of maximum contaminant level goals (MCLGs), which are non-enforceable health-based goals, and maximum contaminant levels (MCLs), which are enforceable limits set as close to MCLGs as possible, considering cost and feasibility of attainment.

The SDWA **Underground Injection Control (UIC)** program (40 CFR Parts 144-148) is a permit program which protects underground sources of drinking water by regulating five classes of injection wells. UIC permits include design, operating, inspection, and monitoring requirements. Wells used to inject hazardous wastes must also comply with RCRA corrective action standards in order to be granted a RCRA permit, and must meet applicable RCRA land disposal restrictions standards. The UIC permit program is primarily State-enforced, since EPA has authorized all but a few States to administer the program.

The SDWA also provides for a Federally-implemented Sole Source Aquifer program, which prohibits Federal funds from being expended on projects that may contaminate the sole or principal source of drinking water for a given area, and for a State-implemented Wellhead Protection program, designed to protect drinking water wells and drinking water recharge areas.

*EPA's Safe Drinking Water Hotline, at (800) 424-7991, answers questions and distributes guidance pertaining to SDWA standards. The Hotline operates from 9:00 a.m. through 5:30 p.m., ET, excluding Federal holidays.*

*Toxic Substances Control Act (TSCA)*

TSCA granted EPA authority to create a regulatory framework to collect data on chemicals in order to evaluate, assess, mitigate, and control risks

which may be posed by their manufacture, processing, and use. TSCA provides a variety of control methods to prevent chemicals from posing unreasonable risk.

TSCA standards may apply at any point during a chemical's life cycle. Under TSCA §5, EPA has established an inventory of chemical substances. If a chemical is not already on the inventory, and has not been excluded by TSCA, a premanufacture notice (PMN) must be submitted to EPA prior to manufacture or import. The PMN must identify the chemical and provide available information on health and environmental effects. If available data are not sufficient to evaluate the chemicals effects, EPA can impose restrictions pending the development of information on its health and environmental effects. EPA can also restrict significant new uses of chemicals based upon factors such as the projected volume and use of the chemical.

Under TSCA §6, EPA can ban the manufacture or distribution in commerce, limit the use, require labeling, or place other restrictions on chemicals that pose unreasonable risks. Among the chemicals EPA regulates under §6 authority are asbestos, chlorofluorocarbons (CFCs), and polychlorinated biphenyls (PCBs).

*EPA's TSCA Assistance Information Service, at (202) 554-1404, answers questions and distributes guidance pertaining to Toxic Substances Control Act standards. The Service operates from 8:30 a.m. through 4:30 p.m. ET, excluding Federal holidays.*

### *Clean Air Act (CAA)*

The CAA and its amendments, including the Clean Air Act Amendments (CAAA) of 1990, are designed to "protect and enhance the nation's air resources so as to promote the public health and welfare and the productive capacity of the population." The CAA consists of six sections, known as Titles, which direct EPA to establish national standards for ambient air quality and for EPA and the States to implement, maintain, and enforce these standards through a variety of mechanisms. Under the CAAA, many facilities will be required to obtain permits for the first time. State and local governments oversee, manage, and enforce many of the requirements of the CAAA. CAA regulations appear at 40 CFR Parts 50-99.

Pursuant to Title I of the CAA, EPA has established national ambient air quality standards (NAAQSs) to limit levels of "criteria pollutants," including carbon monoxide, lead, nitrogen dioxide, particulate matter,

ozone, and sulfur dioxide. Geographic areas that meet NAAQSs for a given pollutant are classified as attainment areas; those that do not meet NAAQSs are classified as non-attainment areas. Under §110 of the CAA, each State must develop a State Implementation Plan (SIP) to identify sources of air pollution and to determine what reductions are required to meet Federal air quality standards.

Title I also authorizes EPA to establish New Source Performance Standards (NSPSs), which are nationally uniform emission standards for new stationary sources falling within particular industrial categories. NSPSs are based on the pollution control technology available to that category of industrial source but allow the affected industries the flexibility to devise a cost-effective means of reducing emissions.

Under Title I, EPA establishes and enforces National Emission Standards for Hazardous Air Pollutants (NESHAPs), nationally uniform standards oriented towards controlling particular hazardous air pollutants (HAPs). Title III of the CAAA further directed EPA to develop a list of sources that emit any of 189 HAPs, and to develop regulations for these categories of sources. To date EPA has listed 174 categories and developed a schedule for the establishment of emission standards. The emission standards are being developed for both new and existing sources based on “maximum achievable control technology (MACT).” The MACT is defined as the control technology achieving the maximum degree of reduction in the emission of the HAPs, taking into account cost and other factors.

Title II of the CAA pertains to mobile sources, such as cars, trucks, buses, and planes. Reformulated gasoline, automobile pollution control devices, and vapor recovery nozzles on gas pumps are a few of the mechanisms EPA uses to regulate mobile air emission sources.

Title IV establishes a sulfur dioxide emissions program designed to reduce the formation of acid rain. Reduction of sulfur dioxide releases will be obtained by granting to certain sources limited emissions allowances, which, beginning in 1995, will be set below previous levels of sulfur dioxide releases.

Title V of the CAAA of 1990 created an operating permit program for all "major sources" (and certain other sources) regulated under the CAA. One purpose of the operating permit is to include in a single document all air emissions requirements that apply to a given facility. States are developing the permit programs in accordance with guidance and regulations from EPA. Once a State program is approved by EPA, permits will be issued and monitored by that State.



Title VI is intended to protect stratospheric ozone by phasing out the manufacture of ozone-depleting chemicals and restricting their use and distribution. Production of Class I substances, including 15 kinds of chlorofluorocarbons (CFCs), will be phased out entirely by the year 2000, while certain hydrochlorofluorocarbons (HCFCs) will be phased out by 2030.

*EPA's Control Technology Center, at (919) 541-0800, provides general assistance and information on CAA standards. The Stratospheric Ozone Information Hotline, at (800) 296-1996, provides general information about regulations promulgated under Title VI of the CAA, and EPA's EPCRA Hotline, at (800) 535-0202, answers questions about accidental release prevention under CAA §112(r). In addition, the Technology Transfer Network Bulletin Board System(modem access (919) 541-5742)) includes recent CAA rules, EPA guidance documents, and updates of EPA activities.*

## **VI.B. Industry Specific Requirements**

Effluent guidelines were promulgated for various subcategories of the pulp and paper industry in 1974 and 1977, with additional guidelines promulgated in 1982, primarily in the secondary fiber and nonintegrated segments of the industry. Pulp and paper facilities also may generate a number of wastestreams that are subject to RCRA requirements. In addition, they are frequently large emitters of VOCs, NO<sub>x</sub>, SO<sub>x</sub> and reduced sulfur compounds and thus may be subject to state requirements established by the State Implementation Plan (SIP) process. New Source Performance Standards under the Clean Air Act have been in place since 1978. In addition, all but the smaller pulp and paper mills, in terms of employees and chemical usage, are also subject to Emergency Planning and Community Right-to Know Act requirements.

Trends in the industry's production technologies and processes are greatly influenced by a series of environmental regulations initiated in 1974. Pulp and paper mills are currently the subject of an integrated rulemaking covering effluent guidelines for process wastewater discharges and National Emissions Standards for Hazardous Air Pollutants (NESHAP). RCRA rules under development may also affect wastewater treatment in surface impoundments. In addition, an ongoing risk assessment will determine the need for additional restrictions on the disposal of wastewater treatment sludge.

## **Federal Statutes**

*Clean Air Act (CAA)*

In 1978, under §111 of the CAA, EPA promulgated New Source Performance Standards (NSPS) to limit emissions of particulate matter (PM) and total reduced sulfur (TRS) for kraft pulp mills (FR 7568). The NSPS applied specifically to: recovery furnaces, smelt dissolving tanks, lime kilns, digester systems, brownstock washer systems, multiple effect evaporators, black liquor oxidation systems, and condensate stripper systems. The 1978 NSPS also applies to existing plants modified after September 24, 1976. Minor revisions and corrections to these regulations were promulgated on May 20, 1986 (FR 18538). Under §111(d), the CAA covers state plans for control of existing sources of non-criteria pollutants (e.g., TRS). Section 112 concerns hazardous air pollutant standards, some of which affect the pulp and paper industry.

Title I - Provisions for Attainment and Maintenance of the National Ambient Air Quality Standards:

- NO<sub>x</sub> and SO<sub>x</sub> controls established as part of State Implementation Plans (SIPs) may be applicable to energy generation at some mills.

Air emissions from pulp and paper mills are more often covered by state regulations rather than federal regulations (although the state requirements are often federally enforceable as part of the State Implementation Plan). Kraft pulp mills that have been constructed or modified after September 24, 1976 may be subject to New Source Performance Standard (NSPS) emission limitation, monitoring, and reporting requirements at 40 CFR Part 60 Subpart BB, which limit particulate matter and total reduced sulfur (TRS). (Existing kraft pulp mill sources are often covered by state TRS emission limitations, many of which were established under Clean Air Act Section 111(d)). In addition, fossil-fuel-fired boilers that heat water or other heat transfer media and have a heat input rate over 250 million Btu per hour are subject to NPS limits for particulate, sulfur dioxide, and nitrogen oxide under 40 CFR Part 60 Subpart D, if constructed or "modified" after August 17, 1971. Fossil-fuel-fired boilers that commence construction or "modification" after June 19, 1984 may be subject to more stringent limits for particulate, sulfur dioxide, or nitrogen oxide under Subpart Db; those NPS regulations apply to fossil-fuel-fired boilers greater than 100 million Btu per hour. NSPS for smaller boilers, between 10 and 100 million Btu per hour, have construction or "modification" after June 9, 1989. Some mills also operate gas turbines subject to NSPS in 40 CFR Part 60 Subpart GG.

Frequently, pulp and paper mills have installed new equipment or modified equipment that produced a significant net emissions increase above thresholds for the Prevention of Significant Deterioration (PSD) or nonattainment new source review (NSR) regulations. In those cases, the source should have received a PSD/NSR permit from either EPA or the state air pollution control agency, and such permits impose additional limitations beyond those contained in federal and state categorical emission standards, including emission limitations based on the Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) for pollutants for which there was a significant increase.

State air pollution regulations frequently impose numerous additional limitations on emissions from pulp and paper mills, including limits on both stack and fugitive emissions of particulate matter, volatile organic compound emission limitations or usage restrictions, and TRS emission limitations designed to control odor.

#### *Resource Conservation and Recovery Act (RCRA)*

The pulp and paper industry generates a variety of RCRA wastes, but most are managed through wastewater treatment systems. RCRA listed wastes outside of wastewater streams are typically generated in small quantities. Other wastes may be managed on a case-by-case basis as hazardous where one or more hazardous characteristics (e.g., ignitable, toxic, reactive, corrosive) are found. The majority of the industry's wastestreams are nonhazardous wastewaters and sludge. The industry has a pulping liquor exemption.

As a result of an Environmental Defense Fund suit and resultant consent decree, the "RCRA mega-deadline" requires EPA to consider whether paper mill wastewater treatment sludges meet the criteria for listing as hazardous wastes. This determination is expected to occur pursuant to completion of the final effluent guidelines. The exception to this requirement is for effluent guidelines based on the use of oxygen delignification, ozone bleaching, prenox bleaching, enzymatic bleaching, hydrogen peroxide bleaching, oxygen and peroxide enhanced extraction, or any other technology involving substantially similar reductions in uses of chlorine-containing compounds. EPA has deferred any work on the proposed regulations regarding land application of sludges because the AF&PA and EPA signed the land application stewardship agreement.

#### *Emergency Planning and Community Right-to-Know Act (EPCRA)*

- Emergency Planning (§302(a)) - Businesses that produce, use or store "hazardous chemicals" at or above "threshold planning quantities" must: 1) submit material safety data sheets or the equivalent, and 2) Tier I/Tier II annual inventory report forms to the appropriate local emergency planning commission. Those handling "extremely hazardous substances" are also required to submit a one-time notice to the state emergency response commission.
- Emergency Notification of Extremely Hazardous Substance Release (§304) - A business that unintentionally releases a reportable quantity of an extremely hazardous substance must report that release to the state emergency planning commission and the local emergency planning commission.
- Release Reporting (§313) - Manufacturing businesses with ten or more employees that manufactured, processed, or otherwise used a listed toxic chemical in excess of the "established threshold" must file annually a Toxic Chemical Release form with EPA and the state. Approximately 296 pulp and paper facilities nationwide submitted forms summarizing their chemical releases in 1992. Documentation supporting release estimates made must be kept for three years.

### *Clean Water Act (CWA)*

On May 9, 1974, May 29, 1974 and January 6, 1977, EPA promulgated a series of effluent guidelines for different subcategories within the pulp, paper, and paperboard industry. These regulations focused on reducing conventional pollutants, such as biochemical oxygen demand, suspended solids, and pH following some revisions and additional focus on toxic pollutant discharges regulations were revised in 1982 and 1986 (51 FR 45232). The existing effluent guidelines (BPT, BAT, NSPS, PSES, include PSN (47 FR 52006) were promulgated on November 18, 1982 for all but one of the pulp, paper and paperboard subcategories. BCT standards were promulgated in 1986 .

Wastewater discharges from most pulp and paper mills are covered by BCT and BAT effluent limitations guidelines (or, in the case of indirect discharges, pretreatment standards) in 40 CFR Part 430. Those regulations specify production-based effluent limitations for biochemical oxygen demand, total suspended solids, and pH. Many pulp and paper mills have NPDES permit limitations more stringent than the BCT and BAT guidelines would allow, because they discharge to water-quality-limited

streams. Those limitations are derived by the permitting authority pursuant to Clean Water Act section 301 (b)(1)(C) and 40 CFR § 122.44(d). For many bleached chemical pulp mills, water-quality-based permit limitations for 2,3,7,8-TCDD have been issued as Individual Control Strategies under Clean Water Act Section 304(1).

Of course, pulp and paper mills are also potentially subject to numerous other generic regulations under the Clean Water Act, such as stormwater permitting requirements, spill control planning requirements for facilities that store petroleum products, general pretreatment standards under 40 CFR Part 403 for indirect dischargers, and permitting for dredge and fill activities under Clean Water Act Section 404. Most states also have their own discharge permitting and water pollution control regulations.

### State Statutes

In 1986, six states (CA, KY, LA, MD, NC, and SC) had fully EPA-approved Section 111(d) plans to control TRS at kraft pulp mills, two states had approved TRS standards but their compliance schedules had not yet been approved (AR and GA), and Tennessee's and Florida's plans had been submitted to Region IV for approval. Since that time, a number of states have received approval on their plans to control TRS from existing kraft pulp mills under Section 111(d). In addition, in 1986, twelve states had state regulations on kraft pulping TRS emissions outside of Section 111(d) approved plans (AL, AZ, FL, ID, MT, NH, OH, OK, OR, TN, VA, and WA). In general, particulate matter (PM) emissions limits are established on a per ton of pulp produced basis and/or for specific processes (e.g., lime kilns, smelt tanks, and recovery furnaces). Certain states also established opacity limits and performance standards for specific processes. Investigations related to the integrated rulemaking identified seventeen states with regulations specific to the pulp and paper industry. (Contact: Debra Nicoll OW, ESAB 202-260-5385)

### **VI.C. Pending and Proposed Regulatory Requirements**

In 1992, the pulp and paper industry was identified in the Source Reduction Review Project (SRRP) as an industry for which a more integrated (across environmental media) approach to rulemaking was warranted. In addition, the Senior Policy Council emphasized that upstream process controls were to be investigated as possible regulatory control options (Contact: Jordan Spooner 202-260-4418). On December

17, 1993, EPA proposed integrated NESHAP and effluent guidelines for the pulp and paper industry. The rules apply to mills in SIC codes 2611, 2621, 2631, and 2661. One key element of the integrated rulemaking was to propose revisions to EPA's subcategorization scheme for effluent guidelines. (The table identifies which proposed rules apply to the various pulp and paper subcategories.) The Agency is currently re-evaluating the 1993 proposal based on comments and new information.

<b>Exhibit 30: Scope of Proposed Integrated Air and Water Rules for Pulp and Paper</b>					
Effluent Guidelines		CAA NESHAP	Clean Water Act		
Subcategory	Subpart		Toxics: BAT/PSES	Conventionals : BPT	BMPs*
Dissolving Kraft	A	X	X	X	X
Bleached Papergrade Kraft and Soda	B	X	X	X	X
Unbleached Kraft	C	X	X	X	X
Dissolving Sulfite	D	X	X	X	X
Papergrade Sulfite	E	X	X	X	X
Semi-Chemical	F	X	X	X	X
Mechanical Pulp	G			X	
Non-Wood Chemical	H			X	X
Secondary Fiber Deink	I			X	
Secondary Fiber Non-Deink	J		X (New Sources)	X	
Fine and Lightweight Papers from Purchased Pulp	K			X	
Tissue, Filter, Nonwoven, and Paperboard from Purchased Pulp	L			X	
* Under §304(e) of CWA, EPA proposed Best Management Practices to prevent spills and other losses of pulping liquor.					

### *Clean Air Act Amendments of 1990 (CAAA)*

The Clean Air Act Amendments of 1990 included a number of provisions for which the Agency will develop regulations likely to affect pulp and paper facilities directly. Most relevant is the NESHAP for pulp and paper which has been integrated with the proposed effluent guidelines under the Clean Water Act in a recent proposal. (Contact: Penny Lassiter 919-541-5396)

Title I - Provisions for Attainment and Maintenance of the National Ambient Air Quality Standards:

- Ozone nonattainment areas are classified as: marginal, moderate, serious, severe, or extreme. "Major" stationary sources are defined as having potential emissions of 50 tons of VOCs per year in serious areas; 25 tons per year in severe areas; and 10 tons or more in extreme areas. For all other areas, a major source is one that releases 100 tons of VOCs per year. Based on TRI, over 150 pulp and paper facilities release an average of almost 500 tons of methanol per year. Pulp and paper facilities designated a major source are subject to Reasonably Available Control Technology (RACT) requirements. The state must develop and adopt non-CTG (Control Techniques Guidelines) RACT rules for such sources.

Title III - National Emissions Standards for Hazardous Air Pollutants (NESHAP):

- Maximum Achievable Control Technology (MACT) standards are scheduled for a list of 189 Hazardous Air Pollutants (HAPs) listed in §112(b). MACT standards for the pulp and paper industry were proposed along with the effluent guidelines in December 17, 1993. The proposed MACT standard was assumed to control emissions of methanol, hexane, toluene, methyl ethyl ketone, chloroform, chlorine, formaldehyde, acrolein, and acetaldehyde, many of which are VOCs subject to RACT rules under Title I. The air emission points selected for the proposed regulations included all significant points in the pulping and bleaching processes and in the process wastewater collection and treatment systems. Air and water sampling at 16 chemical pulp mills was conducted during 1993 and 1994 by American Forest and Paper Association member companies and the National Council of the Paper Industry for Air and Stream Improvement to assist EPA in developing MACT standards.

*Clean Water Act (CWA)*

As part of a consent decree with the Environmental Defense Fund and the National Wildlife Federation, EPA was to review the need for revised rulemaking applicable to dioxins and furans for the pulp and paper industry, including wastewater treatment sludge. The analysis of risks pays particular attention to cross-media exposure pathways. OSWER and OPPTS are the lead offices for this effort. One of the key follow-up rulemaking efforts to implement this decree were the revised effluent guidelines under the CWA. In coordination with OSW and OAQPS, the Office of Water proposed effluent guidelines for the pulp and paper industry. Revised BPT and BCT limitations are proposed for all facilities



to control conventional pollutants, such as BOD and TSS. BPT concentration limits were based on water recycling and end-of-pipe treatment. Limitations for toxic and non-conventional pollutants were based on the Best Available Technology Economically Achievable (BAT) to the assigned subcategory. BAT technologies relied in-part on in-process controls and modifications. EPA also proposed NSPS and pretreatment standards for both new and existing indirect dischargers. (Contact: Donald Anderson 202-260-7137; David Layland, OSWER, 202-260-4796; Gale Cooper, OPPTS, 202-260-1855)

#### *Resource Conservation and Recovery Act (RCRA)*

Two common practices in the pulp and paper industry may be affected by upcoming RCRA rules. First, as a result of the multi-pathway risk assessment, it may be determined that land application of wastewater treatment sludge is too risky. A separate consent decree (*EDF v. Reilly*) requires EPA to consider whether sludge meet the criteria for listing as hazardous wastes, although EPA had proposed a TSCA §6 rule limiting soil concentrations of dioxins and furans. Second, combining of wastewaters in surface impoundments is allowed if there are no hazardous constituents after dilution. The point of generation principle which does not allow dilution prior to removal/minimization of the hazardous character of the waste (in this case corrosivity or ignitability) does not strictly apply. Under an emergency interim rule (58 FR 29860), CWA systems are not immediately affected and current practices are acceptable for now. RCRA rulemakings addressing these systems are scheduled to be finalized in 1995 and 1996 although some requirements of the final integrated rule may address the issues of concern under RCRA.

